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Successful Methods

CONSTRUCTION-ROAD MAKING-ENGINEERING-INDUSTRIAL-MINING

VOL. 2 JULY 1920 NO. 7

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Successful Methods

A Magazine of Construction Service

Published by
MANUFACTURERS PUBLICITY BUREAU
INCORPORATED
140 South Dearborn Street, Chicago.

Vol. II | July, 1920 | No. 7

PARTNERS

There is only one sort of partner worth having, and that is one who works with you, and, by working with you, enables you to accomplish things that you cannot do alone.

That is the sort of partnership in which men and machines are working all over the world. Without the man the machine is useless—it cannot run itself. Without the machine the man's usefulness and earning power are limited to the feeble efforts of his hands. Together they can move mountains. Go down to Arizona and see men and machines digging away mountains to uncover the ore underneath.

True partners must do more than work together. They must work together harmoniously, without discord and bickerings. Too often partnerships between men are ruined by quarrels, but a machine won't quarrel with you. You can always depend upon it to do its best, and what more can you ask of a partner.

But don't forget your side of the bargain. The machine will do its best, but its best will be measured by the care and attention it receives. A machine that is neglected, is allowed to run too long without oiling or cleaning, will do its best, but its best won't amount to much.

Give the machines that work with you the care they deserve. Probably you do. Well then, keep up the good work. You won't regret it when you come to a particularly tough piece of work and your machine goes at it with a sturdy strength that is the direct result of the time spent in caring for your partner.

After all what better example of partnership is there than the man and the machine working together daily, doing together far more than either could do alone, opening up new fields of work by the very might and power of their combined effort? Partners in the truest and best sense of the word.

This Magazine Will Be Sent to Men Who Can Use It.
This Issue Has a Circulation of More Than 75,000.

EDITORIALS

The Adventurers

IN an article appearing elsewhere in this issue of SUCCESSFUL METHODS, the Erie Canal, built a century ago, is aptly described as the first great school for contractors in the United States. And that is just what it was. For those days it was a stupendous job and it seemed next to impossible to find anyone to undertake it.

But then as now, there were men fired with the same spirit of adventure that even today lends a touch of romance to the contracting business. There were men who wouldn't admit that any job was too big for them, who were willing to take a chance, to risk their all in the construction of the nation's first great inland waterway. Some fell by the wayside, others succeeded, but the canal was built.

The world is still waiting to see the job that no contractor will tackle. The spirit of adventure is still on the job and bids fair to remain there so long as there exists the man who is proud to call himself a contractor.

Coming Back to Earth

TOO much romance and adventure are just as harmful to contractors as to any other class of human beings. That is one reason why Successful Methods includes in this issue an article entitled "Do You Know Your Costs?" Here and there, the author of this article treats the contractors a little roughly because so many of them work along from day to day from year to year, with only the haziest notions of costs. If they make money on a job, "All right"! if they lose, "Better luck next time"! but in far too many cases they are unable to single out the items which have made the difference between profit and loss.

Contracting is a great game, but like every other game it has rules which must be observed in order to assure success. Sometimes you can beat the rules, but that doesn't happen often.

And one of the cardinal rules is to know just what you are doing every step you take. In other words, keep track of your costs. Then if some item is running wild you will discover it before it has had a chance to run you into bankruptcy.

So if the author now and then seems to criticise contractors a little too harshly, don't object. He knows that all contractors are not careless about such matters, but too many of them are, and the article may help them to see the light.

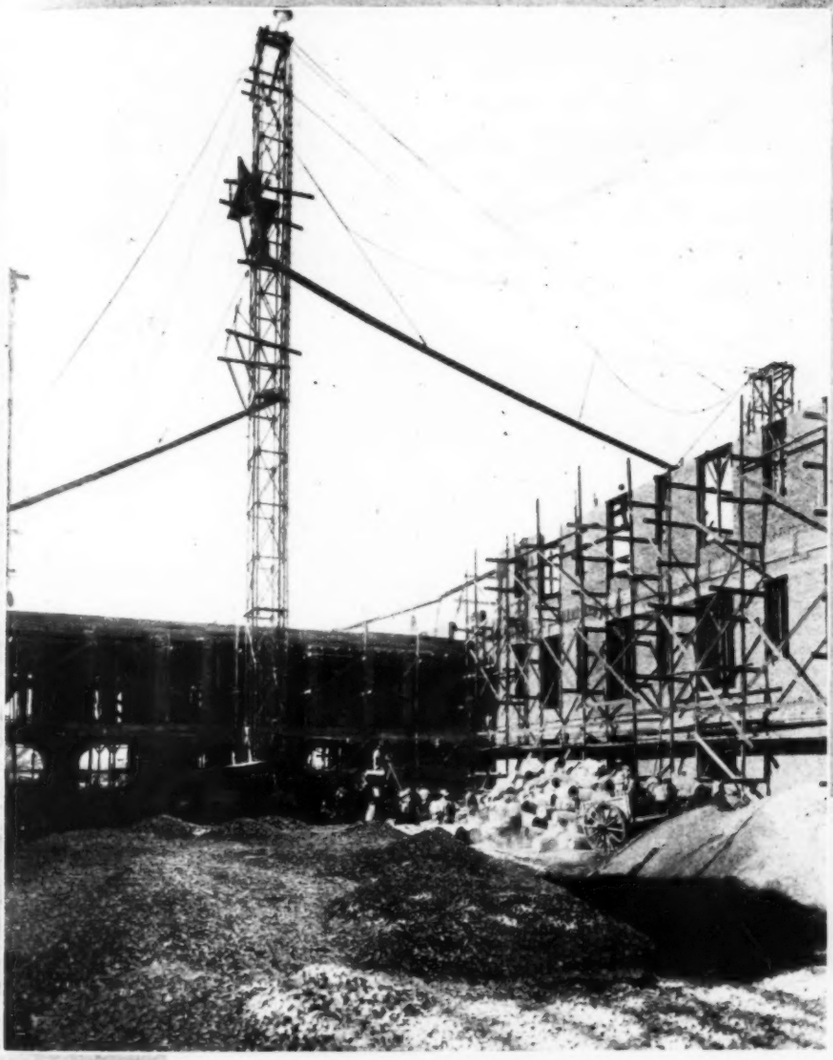
Our Congratulations

JOHN N. MACKALL, the Chief Engineer of the State Roads Commission of Maryland, has been appointed Chairman of the Commission. He retains his old duties in addition to the new ones.

SUCCESSFUL METHODS congratulates Mr. Mackall upon his promotion. Many of its readers will remember the article which he contributed to the April issue. Before his elevation to his new job he promised to write again for this magazine, and it is to be hoped that his new duties will not prevent the fulfilment of that promise.

Raising the Grade on a Pennsylvania Highway

CUBA PREPARES FOR NEXT WINTER



For reasons which need no mention, Cuba expects another flood of American tourists next winter. The two views on this page show the Hotel Almendares now being built with American machines by Cuban contractors. The crushing plant shown in the lower picture is only a short distance from the hotel. The contractors are Arellano and Mendosa.

DOWN IN SOUTH AMERICA

Machinery from the United States is helping to develop South America. In the small picture to the right an industrial car in the Chilean nitrate fields is proving that it can stand rough usage. In the central photograph Chilean officials are watching the first performances of a scarifier from the United States. At the bottom of the page a portable crushing plant is at work on a reservoir job near Lima, Peru.

AND ACROSS THE ATLANTIC

There is plenty of room for American machinery in the Old World. At the left is the breakwater at Barcelona, Spain, smashed by a violent storm. The house in the center of the page is near Berlin and shows how the Germans are solving the housing problem. A little coal handling machinery would make life much easier for the women in the photograph at the bottom. They are coaling ship at Bilboa, Spain.

LAST APPORTIONMENT OF FEDERAL AID IS NOW AVAILABLE—$97,000,000 TO BE DISTRIBUTED

By Thomas H. MacDonald
Chief of Bureau of Public Roads

THE last apportionment of Federal funds to aid the States in road construction under the existing Federal Aid Act will become available July 1. This will be the largest apportionment yet certified under the Federal Aid Act, amounting to $100,000,000, three quarters of which is derived from the appropriation of 1919 and $25,000,000 from the original appropriation of 1916. A deduction of $3,000,000 or 3 per cent of the funds, will be made to provide for the expense of administering the Federal Aid Act by the Department of Agriculture. The balance of $97,000,000 will be divided among the states in proportion to their population, area and mileage of post roads. The allotments to the several states from the two portions of the fund are given in the table of apportionment printed below.

Under the law the states are required to enter into formal agreements with the Secretary of Agriculture for the construction upon which this money is to be used before July 1, 1922. Any money which is not taken up before that time will be reapportioned among all the states in the same manner in which the original apportionments are made. All previous apportionments have been taken up in the time allotted, and it is not likely that the states will fail to absorb this last apportionment. To do so, however, will mean that the states must survey, plan, and let contracts for at least $200,000,000 worth of Federal aid road construction in the next two years.

If the states continue to pay more than 50 per cent of the cost, as they have in the past, the cost of the roads constructed with this last apportionment may reach $250,000,000. In other words, it will be necessary to plan for construction at the rate of at least $100,000,000 and probably more, per year. Some appreciation of what that means may be gleaned from the fact that in 1915 the expenditure for all roads in the United States, constructed under State supervision, was only $80,000,000.

Since 1915, however, state highway departments have been greatly expanded, and efficient machinery has been developed which will undoubtedly be able to handle the greater volume of work.

The states have had four years in which to prepare for the expenditure of the large funds which now become available. They expect to be able to handle them. What is of greater concern to them at this time is the condition which may result if Federal appropriations are permitted to lapse. The highway departments should know at least a year in advance what funds are to be available in order that plans may be made for future construction. Unless, therefore, further Federal action is taken in the coming year, the states will be left in doubt as to the future policy of the Government, and the amount of money they must be prepared to expend. Such a contingency would involve a serious setback to the progress of road construction; and should be avoided by early congressional action.

Remainder of 1916 Federal Aid Appropriation

State	Sum apportioned
Alabama	$ 526,220.88
Arizona	343,411.04
Arkansas	421,294.52
California	763,668.88
Colorado	438,939.79
Connecticut	153,337.36
Delaware	40,668.70
Florida	286,861.98
Georgia	674,287.74
Idaho	306,512.48
Illinois	1,091,266.98
Indiana	671,763.32
Iowa	720,332.18
Kansas	717,811.16
Kentucky	487,938.86
Louisiana	340,557.78
Maine	240,057.54
Maryland	216,749.65
Massachusetts	368,197.21
Michigan	722,916.99
Minnesota	710,522.33
Mississippi	451,889.29
Missouri	846,974.90
Montana	501,747.53
Nebraska	533,435.50
Nevada	319,086.11
New Hampshire	103,709.73
New Jersey	296,889.11
New Mexico	399,616.96
New York	1,242,973.28
North Carolina	569,763.45
North Dakota	384,056.95
Ohio	926,561.70
Oklahoma	575,619.58
Oregon	394,038.01
Pennsylvania	1,147,986.51
Rhode Island	58,314.22
South Carolina	359,004.76
South Dakota	403,944.86
Tennessee	565,478.48
Texas	1,465,399.62
Utah	282,393.91
Vermont	112,519.27
Virginia	494,418.46
Washington	361,156.95
West Virginia	265,038.19
Wisconsin	636,236.34
Wyoming	308,428.96
Total	$24,250,000.00

Apportionment of 1919 Federal Aid Appropriation

State	Sum apportioned
Alabama	$ 1,578,662.63
Arizona	1,030,233.12
Arkansas	1,263,883.57
California	2,291,006.63
Colorado	1,316,819.38
Connecticut	460,012.07
Delaware	122,006.11
Florida	860,585.94
Georgia	2,022,863.22
Idaho	919,537.45
Illinois	3,273,800.93
Indiana	2,015,289.95
Iowa	2,160,996.56
Kansas	2,153,433.46
Kentucky	1,463,816.57
Louisiana	1,021,673.35
Maine	720,172.62
Maryland	650,248.96
Massachusetts	1,104,591.62
Michigan	2,168,750.98
Minnesota	2,131,567.00
Mississippi	1,355,667.88
Missouri	2,540,924.70
Montana	1,505,242.60
Nebraska	1,600,306.48
Nevada	957,258.32
New Hampshire	311,129.20
New Jersey	890,667.34
New Mexico	1,198,850.89
New York	3,728,919.83
North Carolina	1,709,290.35
North Dakota	1,152,170.85
Ohio	2,779,685.11
Oklahoma	1,726,858.75
Oregon	1,182,114.02
Pennsylvania	3,443,959.54
Rhode Island	174,942.65
South Carolina	1,077,014.28
South Dakota	1,211,834.58
Tennessee	1,696,435.42
Texas	4,396,198.84
Utah	847,181.75
Vermont	337,557.82
Virginia	1,483,255.37
Washington	1,083,470.84
West Virginia	795,114.58
Wisconsin	1,908,709.01
Wyoming	925,286.88
Total	$72,750,000.00

BUILDING THE ERIE CANAL

"Clinton's Big Ditch" Under Construction a Century Ago Was the Nation's First Great School for Contractors

By Gordon P. Gleason

JUST one hundred years ago, every man in the construction field in the United States had one topic which he was ready and willing to discuss at any time or place. The work of building the Erie Canal from Lake Ontario to the waters of the Hudson was in full swing and the engineers and contractors of the time never wearied of talking about it. Some were optimists and some pessimists just as they line up in opposite camps today when some stupendous construction job is proposed. On that occasion the optimists were right and the pessimists wrong, for "Clinton's Big Ditch" was a glorious success and for a long stretch of years brought wealth into the great state which built the canal.

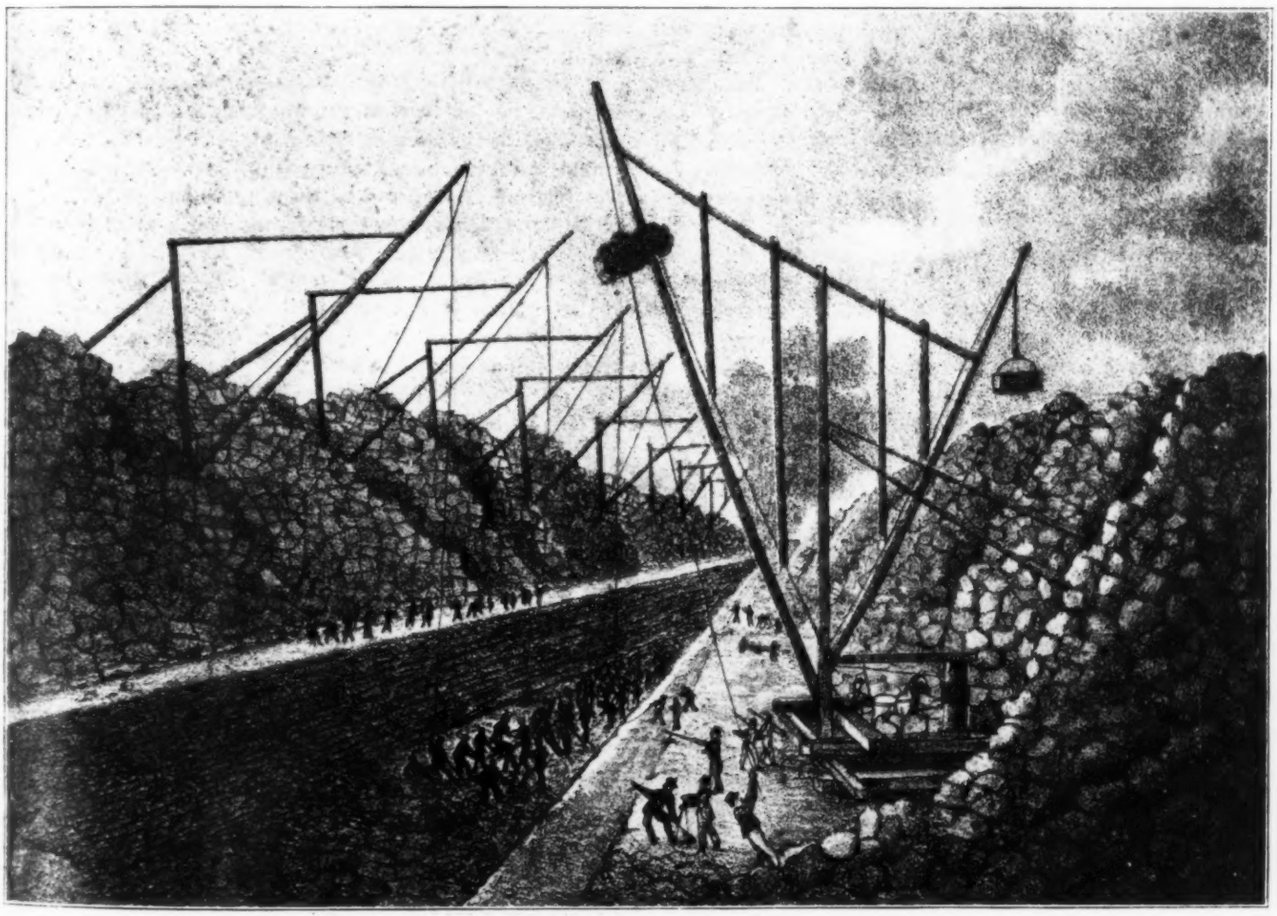
It was the biggest job of its day, and the story of its construction makes interesting reading. The old Erie Canal is now a thing of the past, the new barge canal having taken its place. Successful Methods will tell about both the old and the new, the big canal job of the early years of the nineteenth century, and one of the big jobs of the corresponding period in the twentieth.

From the day that Henry Hudson sailed up the river which bears his name, New York both as a colony and state, has been singularly indebted to its waterways for its development. These natural means of communication formed the first trade routes.

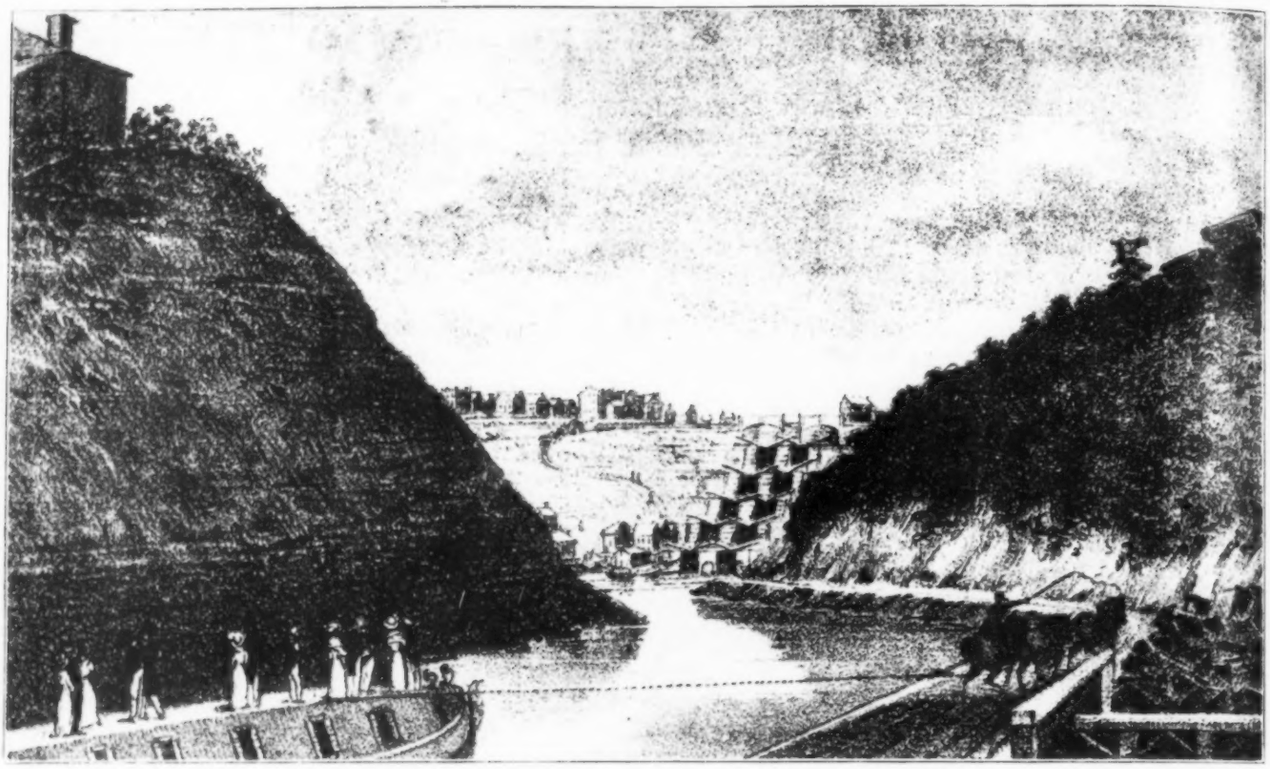
As the population of the State expanded, the need of improving the waterways become more apparent and the first canal locks were constructed at Little Falls in 1790 by a private company acting under a charter granted by the State. There were five locks built by this company, each being a small affair 74 ft. long, 12 ft. wide and having a depth of 3 ft. with lifts ranging from 5 to 9 ft. They were constructed of wood, upwards of 300 laborers being employed.

A few years later, however, the first structures had proved so successful that they were replaced by masonry locks. These early attempts sowed the seeds of the agitation which resulted in the construction of the Erie Canal. At first this project met with bitter opposition but its adherents overcame all objections and, in 1817, work on the channel which meant so much to the future of New York was actually begun, the Erie or "Grand Canal" being completed in 1825.

This channel could not have been constructed at



HARD AT WORK ON A SECTION OF THE ERIE CANAL A CENTURY AGO. THIS ILLUSTRATION AND THREE OTHERS IN THIS ARTICLE APPEAR IN A BOOK PRINTED IN 1825 TO COMMEMORATE THE OPENING OF THE CANAL.



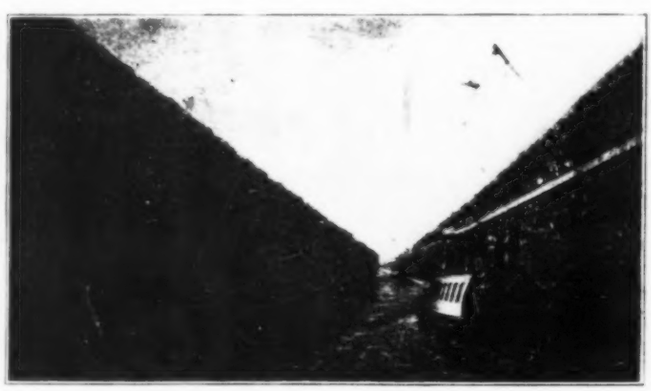
APPROACHING THE LOCKS AT LOCKPORT IN THE OLD DAYS.

that time had it not been that natural conditions made such an undertaking feasible. The key is found in the fact that near Rome, there is a break in the Appalachian Mountain chain extending northward from Georgia and forming a formidable barrier to the west. The Rome summit level is just a little more than 400 ft. above sea level and, as in those days there were no railroads and few passable highways, practically all of the traffic between the Great Lakes and the seaboard passed through this breach.

One would naturally expect that every effort would have been made to improve the natural watercourses, eliminating artificial channels wherever it was possible to do so. The designers of the Erie canal, however, had a very different idea and, on March 11, 1811, the Canal Commissioners reported as follows:

"We beg to observe, on the present navigation of the Mohawk River, Wood Creek, Oneida Lake and Oswego River, from Schnectady to Lake Ontario (saving only a portage at Little Falls, within twelve miles of Oswego), that experience has long since exploded, in Europe, the idea of using the beds of rivers for internal navigation where canals are practicable."

Considering that the proposed canal was to be only 4 ft. deep, undoubtedly the selection of the high level route was, in the main, correct. Here and there, especially toward the head waters of the Mohawk and farther west, it was possible to construct the canal directly in water courses, but in some sections the course of the smaller streams was so crooked that it is doubtful if the builders of those days would have been justified in attempting to canalize them.

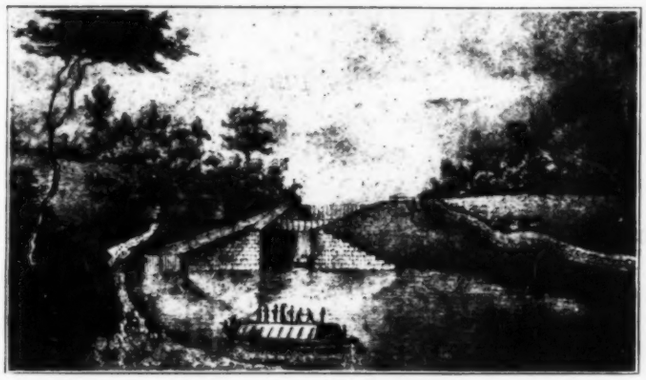


ONE OF THE DEEP CUTS NEAR LOCKPORT.

On April 15, 1817, the legislature authorized the construction of two canals, one connecting the Hudson River with the Seneca River and known as the Erie Canal, and the other connecting Lake Champlain with the Hudson and known as the Champlain Canal. These channels were to have a minimum width of 28 ft. and a depth of 4 ft. the locks being 90 by 15 ft. The estimated cost of the work was $5,752,738. In 1819, the people, realizing that it was necessary to obtain direct access to Lake Erie, caused the legislature to pass a law extending the line of the canal to Buffalo.

All work on this, the nation's first canal, was performed by the contract method, despite the fact that when the work began it is probable that there was not one professional contractor in the United States. The preliminary estimates of cost recognized this handicap and set aside $75,000 for the purchase of tools, it being expected that the State would furnish all equipment to the contractors. However, before the work was awarded the authorities decided that it would be much wiser to let the contractor furnish his own equipment and the item of $75,000 was distributed over the length of the canal to all contractors pro rata.

None of the contractors had any equipment when the canal was first started and records show that in some sections, even wheelbarrows were lacking, laborers carrying the excavated earth out of the ditch on litter-like structures made of boughs. The contractors also lacked financial backing and to keep the work going the State was forced to advance small amounts for the purchase of the tools and various other supplies.



WHERE THE ERIE AND CHAMPLAIN CANALS MET.

It is interesting to note that one of the items which every contractor had to consider was the rations of rum and whiskey he gave to those working for him. In telling of this phase of the work on the original Erie Canal, William Hodge, in his book, "Recollections on Digging the Erie Canal," says:

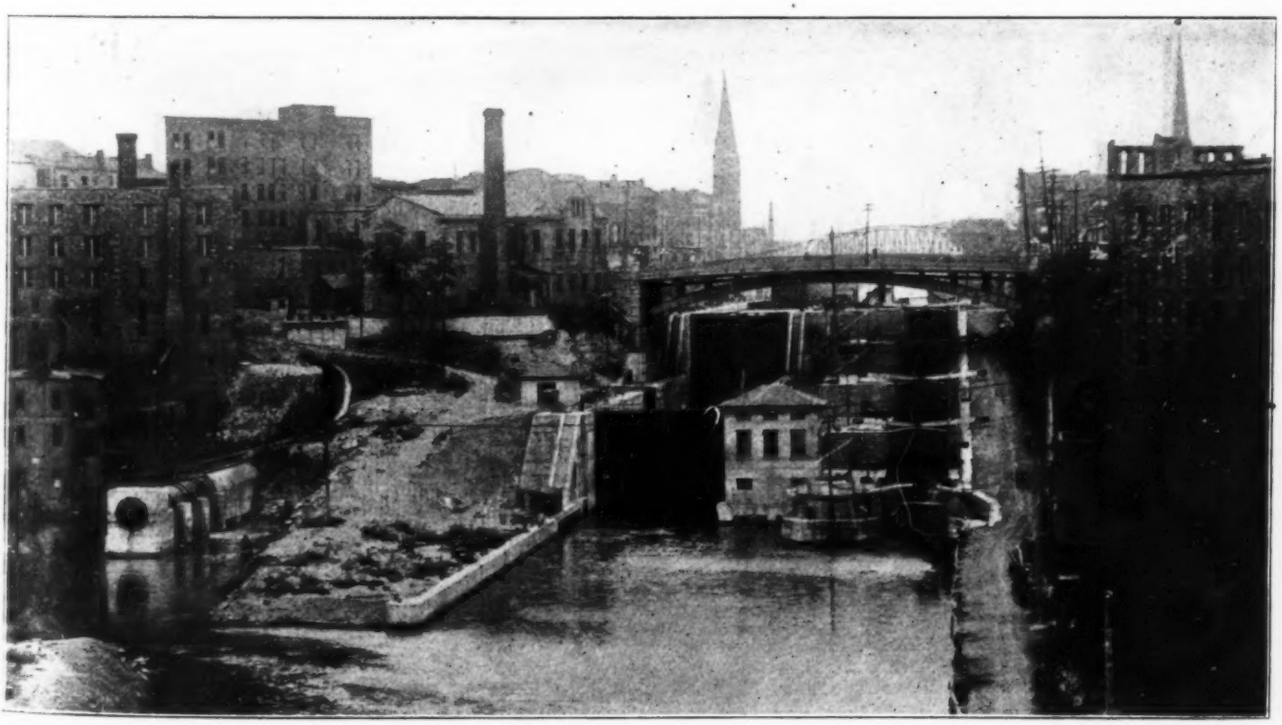
"Along the line of the canal, at convenient places, were to be found barrels of whiskey, pure old rye, with part of the head cut out and a dipper lying by and all were expected to help themselves. It was free for all. This was the only refreshment furnished by those who had charge of the first canal work in the village of Buffalo."

During the construction period, but few types of equipment were developed. But some of these, while primitive, were a great step forward and it is interesting to note that some of the designs were the precursors of modern contracting machinery. One of the curious items was an arrangement for the removal of trees. This consisted of a cable, bound to a wheel working on an endless screw. By attaching the cable to the top of a tree and turning the wheel it was possible for one laborer to fell the largest tree without help.

Another device for pulling stumps is worthy of mention. This was made of an axle, 20 in. in diameter and 30 ft. long, supported on wheels 16 ft. in diameter, while midway on the axle was a rigidly fastened third wheel 14 ft. in diameter. To remove a stump, the outer wheels would be braced against each side of the stump, a chain wound about the axle and fastened to the stump, and horses or oxen hitched to a rope encircling the central wheel. With this device, a yoke of oxen and seven laborers, the contractors were able to grub from 30 to 40 stumps a day.

The Erie Canal was 363 miles long and the Champlain Canal was 78 miles. As soon as the Erie was completed work was begun on a new channel 38 miles in length connecting the Erie with Lake Ontario at Oswego, and another 23 miles long connecting Cayuga and Seneca Lakes with the Erie branch. Numerous other canals were subsequently constructed, but many of these were ill-advised and finally abandoned.

The Erie, Champlain, Oswego and Cayuga-Seneca branches, however, have always been retained by the State, being improved from time to time until 1903 when the people of the State, by referendum, authorized the expenditure of $101,000,000 for the construction of the Barge Canal. This act provided only for the improvement of the Erie, Champlain and Oswego canals but, in 1909, this was supplemented by the authorization of the enlargement of the Cayuga-Seneca Canal at an estimated cost of $7,000,000.



THE OLD AND THE NEW AT LOCKPORT. THE TWO GIGANTIC LOCKS OF THE NEW BARGE CANAL ARE AT THE LEFT, AND BESIDE THEM ARE THE FOUR OLD LOCKS.

YOU CAN'T WORK WITHOUT WATER

Piping System and Pumping Plant Should Be Planned with Great Care

By A. Nydegger

THE pumping plant and piping system on a concrete road paving job are to the paving equipment what the heart and arteries are to the human body. Just as sure as the human body will suffer, if the heart or the arterial system fails to function properly, so will the paving equipment fail if the water supply is not continuous and dependable. The water supply system should receive most careful consideration. The source of supply should be gone over carefully, and the pumping outfit should be selected for dependability rather than for first cost.

The source of supply can be divided into three general heads:

First: Where the job is adjacent to a city, and the water can be taken from the city mains.

Second: Where the water can be pumped from a river, lake or creek or spring, and is not over 20 ft. below the pump.

Third: Where wells must be dug to supply the necessary water.

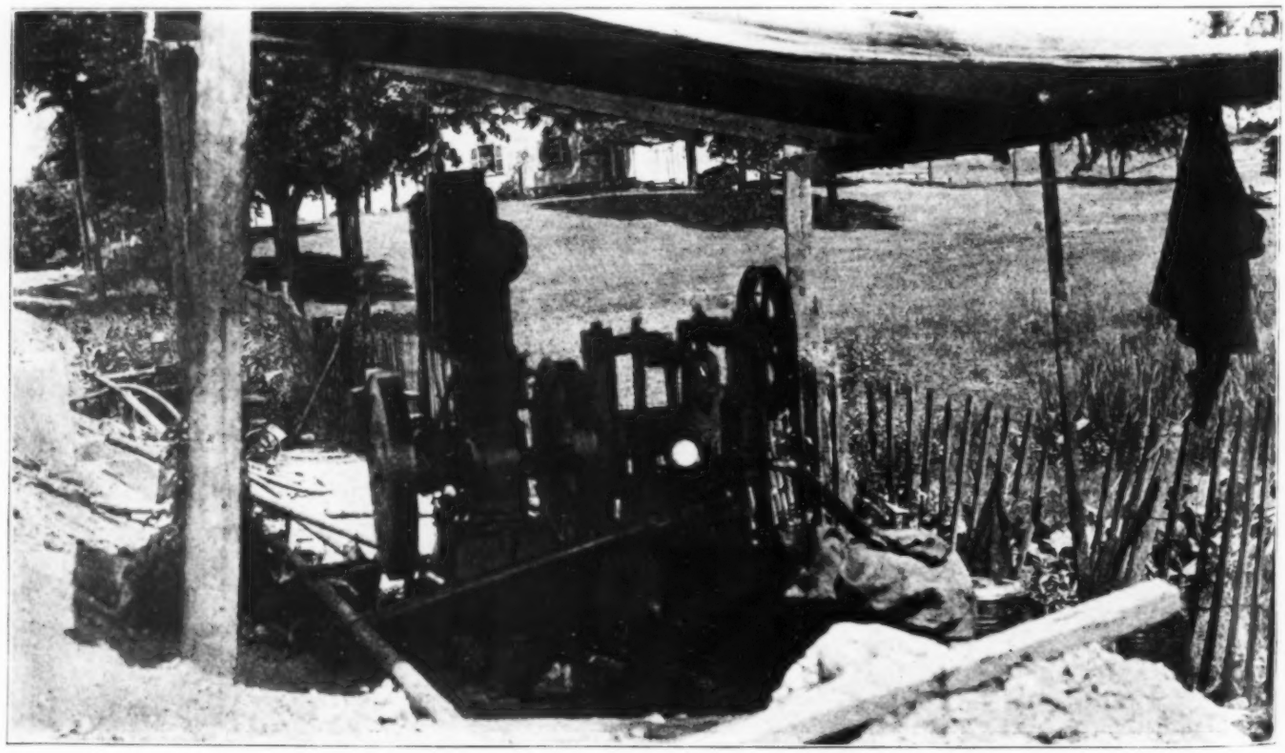
The first case is comparatively simple. Where the water can be taken from the city mains, if the pressure is high enough all that is usually necessary is to connect the pipe line to the nearest hydrant. If the pressure is not high enough to supply the water to the far end of the line, it becomes necessary to put a booster pump in the line. The city water can be connected direct to the suction of the booster pump, or it can be discharged into a tank and picked up out of this tank by the pump and forced into the line. In the latter case, if the city supply is limited, it will have the advantage of the interval, while the mixer is not taking water during each batch to get ahead of the pump. The relief valve in the discharge at the pump must, of course, then be piped into the tank so the surplus water will not be wasted.

Under the second head, when the water can be taken from a lake or river, it may be necessary to locate the pump a half mile or more away from the road if there is no supply adjacent to the paving job.

The pump should be located as near the water as possible. The vertical distance from the pump to the surface of the water should not be over 20 ft. and as much less as possible. No suction pump will lift water much over 20 ft. vertical distance in the suction pipe. The suction pipe may be 200 to 300 ft. long horizontally if necessary, but in that case it should be increased in size to reduce the friction.

The pumping outfit used may be a steam pump or a force pump driven by an electric motor, gasoline or kerosene engine. The steam pump in most localities is much more costly to operate as it requires the constant attendance of an engineer and in many states he must be a licensed engineer. Also, a more or less expensive steam boiler must be provided and a supply of coal hauled.

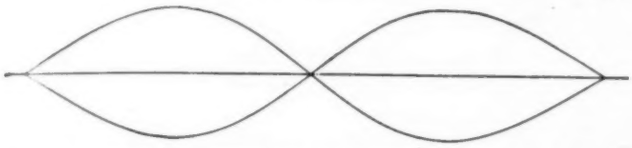
The electric motor-driven outfit is practically eliminated by the fact that electric current is seldom available on a paving job. The gasoline or kerosene engine driven outfit undoubtedly makes the most economical, as well as the most flexible, pumping outfit. It can be set up equally well on one job as another. A barrel of gasoline or kerosense which can be easily hauled to the job will run it a week or more. Also a licensed engineer is not required. A competent man, however, should have charge and



A TRIPLEX PLUNGER PUMP ON A ROAD JOB. IT CAN BE SET UP EASILY, CLOSE TO THE SUPPLY OF WATER, AND ISN'T SO BIG THAT IT GETS IN EVERYBODY'S WAY.

should be responsible for its operation, whether he is in constant attendance or not.

The engine selected for this work should be designed for severe and continuous duty. It must not only work reliably day after day, while the paving crew is working, but often far into the night, watering down the newly laid road, especially during hot weather, and where water is scarce and not sufficient to take care of both the mixer and the sprinkling during the day. It should be equipped



THIS DIAGRAM ILLUSTRATES SUCTION AND DISCHARGE OF A DOUBLE ACTION PISTON PUMP

with a high tension magneto of reliable make for ignition, instead of battery and vibrator coil system wherein the batteries may run down, the innumerable wires break, or the vibrator coil get out of commission.

The lubrication should be taken care of by a good force feed oiler, positively driven and with a liberal oil storage capacity, rather than by sight feed oil cups which must be filled every two or three hours, grease cups which must be screwed down often, and splash lubrication in the crank which is rapidly diluted these days by the residue from the low grade fuel now on the market.

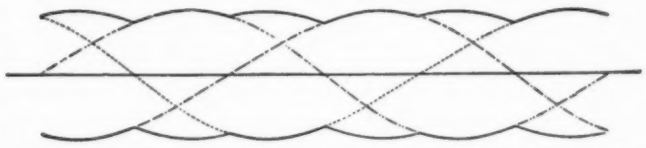
There are two general types of pumps used for this work. The double acting horizontal piston force pump of the bulldozer type and the triplex plunger type. The piston force pump is not recommended for this work, as it is inside packed and is not generally built as ruggedly nor for as high a pressure as the triplex plunger pump. When high hills and long distances are encountered, it may not stand up. This type being horizontal with the piston bearing on the inside of the cylinder there is usually excessive wear on the cylinder and piston, especially if there is any sand or grit in the water. The flow of the water is also not steady as the pressure goes from zero to maximum and back to zero at each stroke or twice each revolution of the pump crank.

The vertical triplex single acting outside packed plunger type of pump is the most practical for the road builder. The pistons being merely displacement plungers, and not bearing on the inside of the cylinder, and guided by liberal crossheads are not subject to much wear. The glands which seal them where they enter the cylinder are easily accessible from the outside. With the cranks 120° apart the power stroke of each plunger overlaps the one immediately preceding it by 60° and there is, therefore, practically a uniform pressure exerted on the water, resulting in a steady flow of water in the pipe line.

The comparison of the power strokes of the double acting piston pump and the triplex plunger pump can be readily seen to be analogous to the four and six cylinder automobile engine as in the four cylinder engine there are fewer power impulses per revolution of the crank shaft, and the flow of power is not as steady as in the six. The two diagrams printed on this page illustrate this point.

The first diagram shows the rate of suction and discharge of a double acting piston during one revolution of the crankshaft. Note that the pressure rises from zero to maximum, twice during each revolution.

The second diagram shows the rate of suction and dis-



THE SUCTION AND DISCHARGE OF A SINGLE ACTING TRIPLEX PUMP IS SHOWN BY THIS DIAGRAM

charge of the individual plunger and also the resultant rate of suction and discharge of the same plungers working together during one revolution of the crankshaft of a single acting triplex pump with cranks 120° apart. Note that the resultant pressure indicated by the heavy line is practically uniform. This uniform pressure is, of course, desirable in the pipe line as it insures a uniform volume of water delivered to the job.

(*Concluded in August issue.*)

VIRGINIA ENTERS MOVIES

THE state of Virginia has adopted the moving picture film in order to further its road building program. C. C. Vaughan, Jr., president of the Virginia Good Roads Association, and D. B. Ryland, the secretary, have arranged for the making of a film to be called "Virginia's New Hour." The film is being produced by James W. Brooks, director of the Education Bureau of the Federal Highway Council, Washington, D. C. When it is completed the film will be shown in all parts of Virginia wherever it will do good. The first showing will be at Richmond and it is expected that Edwin T. Meredith, Secretary of Agriculture, and Thomas H. MacDonald, Chief of the United States Bureau of Public Roads, as well as state and city officials will be present.

HE KNOWS HOW IT GOT THERE

IN the March issue of SUCCESSFUL METHODS there appeared a picture of a horseshoe imbedded in a tree with a caption under it, "How did it get there?" One of the readers of the magazine, Henry Newhall, superintendent of the Danvers Waterworks, Danvers, Mass., comes right back with the following explanation. It sounds plausible, in fact it is more than plausible. It sounds probable.

"That is easy," he says in answer to the question. "You will find in the country that it is a common practice to drive a horseshoe into a tree to hitch horses or clothes lines to. In time the tree grows over it. I know of at least two cases where wood choppers discovered such horseshoes in trees by striking them with an ax."

FROM LAWYER TO CONTRACTOR

Alex MacDougald of Atlanta, Who Entered the Contracting Business as a Life-Saver and Made Good

SOME folks claim that contractors, like poets, are born, not made, and just when their pet theory is looking its best someone like Alex MacDougald of Atlanta, Georgia, happens along and puts it completely out of business.

For Alex MacDougald had no intention of being a contractor up to four years ago. For a long time he earned his living as a fire insurance adjuster and then decided to be a lawyer. So he studied law at the University of Georgia and settled down to the practice of that profession in Atlanta. Along in 1916 his legal duties brought him face to face with a construction company that was in financial difficulties. It had some big contracts on its hands and bade fair to lose a great deal of money on them.

ALEX MAC DOUGALD

That is where Alex MacDougald forsook the law and became a contractor. The construction company was dissolved and he took over its equipment and its contracts. It wasn't an especially encouraging introduction to the new business. The contracts had been made when prices were low, and in the meantime they had more than doubled in many instances. And what could a lawyer know about contracting anyway?

Even if he didn't know anything about contracting, Mr. MacDougald knew something about business and had a good head on his shoulders. His record during the last four years shows that. The contracts which he took over totalled about $250,000, nearly all paving jobs, and with justifiable pride Mr. MacDougald says that he completed them without loss. And don't forget when they were completed—in 1917. The date is important for at that time nearly every bit of available labor was sucked in by the army camps. Just outside of Atlanta, Camp Gordon was built and to get men to do his work Mr. MacDougald had to compete with the prices paid for labor at the camp. To complete these old contracts without loss at such a time surely admits Alex MacDougald to the inner circle of real contractors.

THE SHOVEL WHICH MADE MAC DOUGALD FAMOUS

Once in the contracting business, he couldn't stop and so he is still at it. In 1919 the MacDougald Construction Company was formed and since its organization has handled about $500,000 worth of work.

Paving is the MacDougald Construction Company's job and it has been a pioneer in the Federal Aid work in Georgia. It was the successful bidder for the first Federal Aid job, a 12-mile stretch in Spalding county. This is a concrete road 18 ft. wide and 6½ in. thick. A 10-mile section in Morgan county of 16 ft. concrete 6 in. thick is another MacDougald job.

Right in Atlanta, Mr. MacDougald has done so much paving that it is hard to keep track of it all. One job that he can't forget, however, is the paving of Whitehall street, one of the city's busiest business thoroughfares. By a little quick and quiet action—probably his legal training helped at this juncture — he obtained permission to close up the street entirely, and before anyone knew what was happening he had a big steam shovel hard at work tearing up the old pavement. It was the first steam shovel that ever had ambled down a street in the heart of Atlanta's business section and some persons raised loud and frantic objections to the advent of the monster.

But nearly everyone knew Alex MacDougald and knew that he knew what he was about. Take the testimony of one of the victims as an example. The editor of Successful Methods was standing in front of the Connally Building on Whitehall street talking to Tom Connally. Alex MacDougald's name was mentioned.

"You bet, I know him," said Tom Connally. "Didn't he bring one of those steam shovels right down this street: one of those things which are almost human? And it bit

a piece out of my curbstone right there and knocked a hole through the glass canopy over the sidewalk over our heads here. But MacDougald fixed the canopy all right and he is going to fix the curb just as soon as he can get a piece of steel of the right length. He ordered it and it got lost on the road. But I am not worrying about it. He will make good."

And when a man's victims talk that way about him, it is a pretty safe bet that he is all right. Probably that is why Alex Mac Dougald has made good as a contractor, even though he wasn't born one.

A GREAT CONTRACTOR DIES

THE series of articles appearing now and then in this magazine describing the career of men who have made their mark in their communities as contractors and engineers was to have included an article on Timothy Foley of St. Paul, Minn. The death of Mr. Foley on May 25 last deprives the readers of SUCCESSFUL METHODS of that article, but as Mr. Foley was one of the nation's really great contractors, a brief sketch of his career follows:

Timothy Foley, who was born in Lanark County, Ontario, in 1838, was the oldest of six boys in a family of twelve children. That meant, as it usually does, hard work at an early age. He first learned the lumbering business in Ontario and came to Minnesota in 1879 accompanied by his brother, Michael H. Foley. With two other brothers, they engaged in lumbering in the Northwest and the rapid development of their business soon made it necessary to build railroads to care for it. These roads the Foley brothers built themselves and built them so well that their services as railway contractors soon were in demand. The list of railroads in the building of which the Foleys had a part is a catalogue of the great transportation lines of the Northwest. They are all there—the Great Northern, the Northern Pacific, the Soo, the St. Paul, the Burlington, the Northwestern, all in the United States; and the Canadian Pacific, Canadian Northern, and other lines above the border.

In the early days Timothy Foley worked with his crews, helping in the actual construction work, and that statement explains one reason why he was a successful contractor.

The interests with which he became connected as a contractor showed their appreciation of his worth by drafting him into their service after the actual work of construction was completed, and he was at one time president of the Great Northern and head of a bank.

At the time of his death Mr. Foley was at the head of Foley Brothers, railroad contractors; Foley Brothers, wholesale grocers; and the Flour States Baking Company. He also was a director in numerous business and financial institutions.

In the death of Timothy Foley the contracting field has lost one of its worthiest figures.

CARING FOR EMPLOYEES ON HIGHWAY WORK

By L. L. ROGERS

IN COMPARING highway construction methods with other construction methods the greatest similarity so far as caring for employees is concerned, is to railway construction. A new highway usually starts at a city's limits and extends countrywards, or to the next municipality.

One of the first problems that confronts the contractor on highway work is the transportation of employees to the job and return. His remedy for this lies in his resorting to the railroad construction method of housing and caring for employees at a point on the job easily accessible from detour roads. In location of a camp site the best practice calls for locating it at your unloading point, or as close thereto as possible. Employees then depart for work in the morning and return in the evening by means of the transportation employed on the job.

The purpose of a road plant is to care for its employees; to provide housing facilities for them and a boarding place that will be sanitary and cheerful. To be practical the camp should be portable, built substantially, but with the idea that it can be moved to a new location in a day.

In picking the camp site one should choose high ground, with drainage if possible, plenty of room for dwellings, and all the shade available. In the outlay for a camp a portable frame cook-house, floor, sides and roof built in sections, is ideal. The size of the house depends on the number of men employed. A house 20 ft. wide, 50 ft. long, with 7-ft. sides and pitched roof will accommodate comfortably about 75 men and provide ample room for cook and helpers. Subsidiary to the cook-house should be a meat-house, store-room and sleeping tent, with fly, for the cook and helpers.

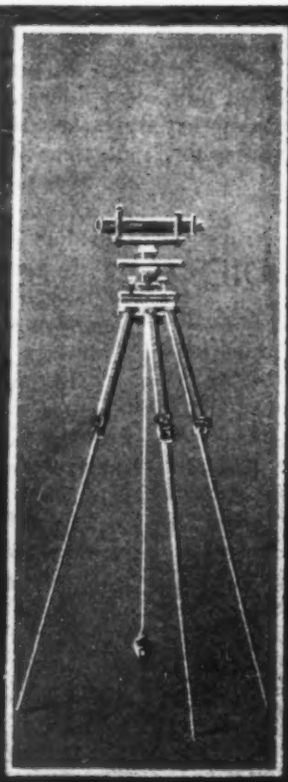
As sleeping quarters for the men, tents 14 ft. by 16 ft., with flys, will accommodate four men conveniently. It is a common practice to furnish 16 ft. by 30 ft. tents, with flys, for common laborers. This tent will comfortably take care of 12 men. If the tents are equipped with iron spring cots and mattresses, allowing the men to furnish their own blankets, the camp should prove attractive and popular.

A shower bath should be installed, connected to a supply tank elevated 10 ft. above ground, which can get its supply from the pipe line furnishing water power to the paver. Along with sanitation and comfort goes the feeding of the men. This department should be well looked after. Good wholesome food, with special dishes to fit nationality of employees, is the secret of success.

An attractive camp, comfortable and sanitary, with a cook-house with a reputation for "good eats" will prove half the battle on a road job. Finally, a highway contract is strung out over several miles. Owing to changing conditions it becomes necessary frequently to change plans overnight. With the foremen and men in camp, a superintendent can revise his plans of an evening and have all departments working smoothly at starting time in the morning.

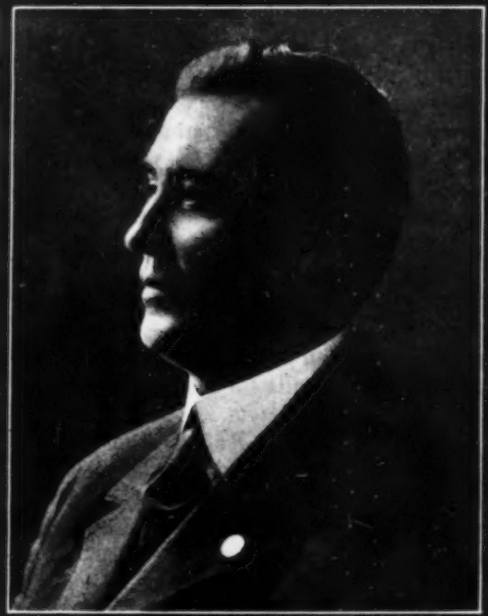
THESE MEN BUILD ROADS

Frederick E. Everett, Commissioner and State Highway Engineer of **New Hampshire,** is a graduate of the Massachusetts Institute of Technology. After his graduation in 1909 he helped install underground conduit for the telephone company in New England, and about a year later engaged in engineering work for the Cambridge Park Department. He remained at Cambridge on various municipal jobs until 1906 when he became an assistant engineer in the New Hampshire State Highway Department. Since 1915 he has held his present position.



C. C. Cottrell, State Highway Engineer of **Nevada,** was born in Auburn, Nebraska, in 1885 and is a graduate of the University of Nebraska. Beginning in 1906, he spent a year in Model Road Construction for the U. S. Office of Public Roads and then put in four years in private engineering practice at Portland, Oregon. After four years with the California Highway Commission he crossed over into Nevada, where he joined the State Highway Department as assistant engineer. Two years ago he was promoted to the office he now holds.

John N. Edy, the Chief Engineer of the State Highway Commission of **Montana,** is a native of Kimswick, Missouri, where he was born in 1883. He is a graduate of the University of Missouri with the degrees of B. S. and C. E. While still in college he engaged in municipal and highway engineering and has spent about thirteen years in that field. In 1918 he entered the State Highway Department of Montana, where he has lived since 1909, as Assistant Chief Engineer, and became Chief Engineer on September 1, 1919.



Herbert Nunn, State Highway Engineer of **Oregon,** began his engineering career as a rodman, continued it in the U. S. Army, and in addition spent seven or eight valuable years in municipal and county work. He went to the Philippines in 1898, then returned to the States, and in 1905 attended the Staff College at Leavenworth. He worked in Mexico and later at El Paso, Texas, when he was City Engineer, and also had charge of County highway work. He was appointed to his present post in 1917.

BIG BIN REDUCES HAULING COSTS

Materials on Road Job in Georgia Never Touch the Ground Until They Have Passed Through the Mixer

THE road work now under construction at Finley, Bibb County, Georgia, by W. Z. Williams of Macon, Ga., affords a splendid example of designing a plant to meet local conditions.

The total length of this contract is 6.6 miles. The M. & B. Railroad crosses the highway at right angles at a point approximately in the middle of the stretch of road to be paved. Using this point as the unloading station, it was possible to construct a whole job with one set-up, and with a maximum haul of 3.3 miles.

Careful study revealed the fact that a spur from the main line of the M. & B. Railroad could be constructed, and by a small amount of grading this track could be carried at an elevation which would permit the erection of a trestle bin.

Three facts influenced the decision to construct a trestle bin. First, the topography of the ground at the unloading site; second, the fact that it was possible to obtain enough 12 yard air dump cars and bottom dump standard gauge cars to supply the job with sand and stone; third, the availability of heavy timber at a reasonable cost. The contractor owned some timber land adjacent to the road and had a small portable saw mill working at the time the road construction started.

The trestle is approximately 540 feet long and provides a storage capacity of about 4,000 tons. Separate compartments are provided for sand and stone. With this arrangement practically all unloading equipment and labor is eliminated. The material is dumped from the standard gauge cars directly into the bins, as illustrated.

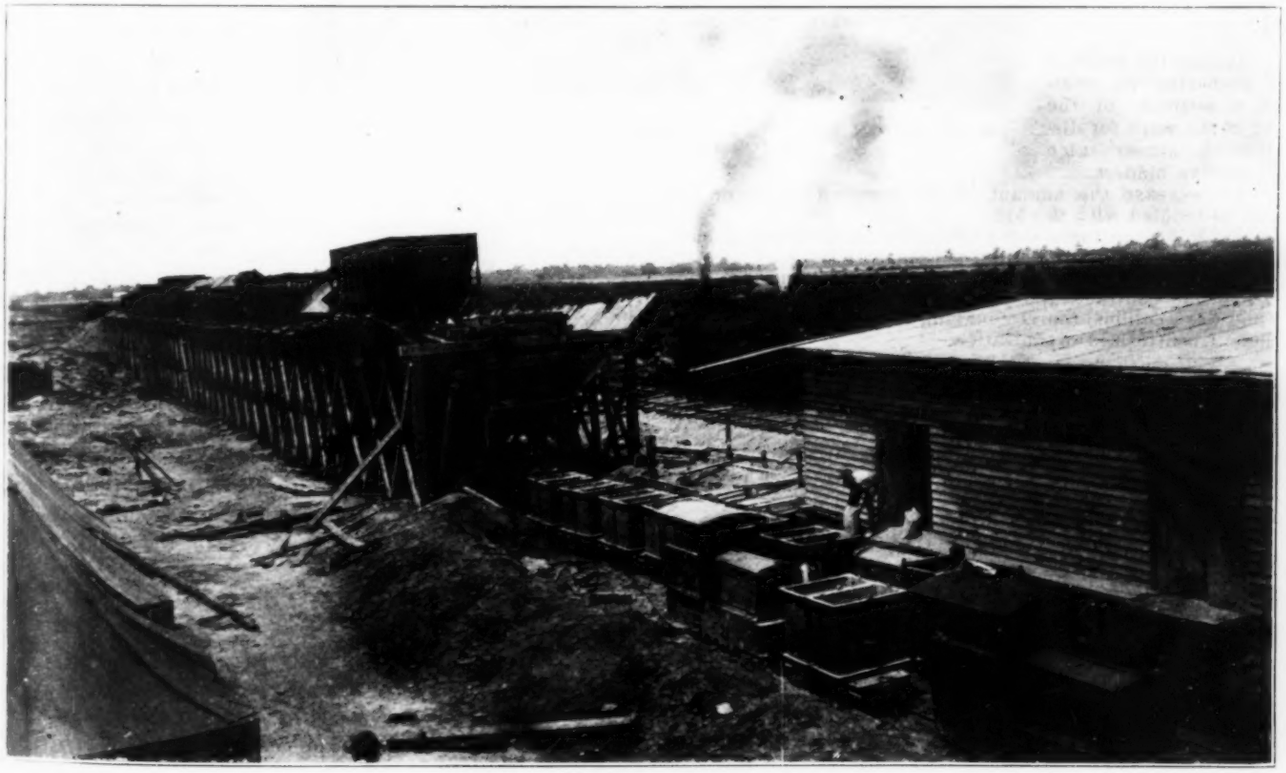
To get the aggregates to the mixer, a 24-inch gauge track, batch boxes, and road builders' trucks with a 6-ton gasoline locomotive are used. The narrow gauge track was laid under the trestle bin, and the materials trapped directly into the batch boxes.

Cement in bags is unloaded into a cement house, which was erected between the standard gauge spur, and the narrow gauge track leading to the trestle. As the train of cars is run out from the trestle, a proper amount of cement is placed in each batch box at the cement house and the train then proceeds to the mixer. The floor of the cement house was constructed approximately level with the top of the batch boxes which makes this loading operation comparatively easy.

A 4-sack paver with the standard crane attachment completes the handling of the batch by dumping the batch boxes directly into the skip of the mixer.

None of the materials used on the entire job touches the ground even for storage purposes until run through the mixer and placed upon the subgrade in the form of mixed concrete.

Because of its size and the efficiency with which it works, the Williams layout has attracted considerable attention among contractors and engineers not only in the South but in other parts of the country.



A GENERAL VIEW OF THE BIG BIN BUILT BY W. Z. WILLIAMS AT FINLEY, GA., SHOWING THE AIR DUMP CARS ON THE TRESTLE AND A STRING OF BATCH BOX CARS EMERGING FROM UNDERNEATH. THE MAN IN THE DOORWAY OF THE BUILDING IS POURING CEMENT INTO THE BATCH BOXES AS THEY STOP OPPOSITE HIM.

DO YOU KNOW YOUR COSTS?

The Keeping of Accurate Accounts Will Help to Solve Many of the Problems Which Now Bother the Average Contractor

By James J. Redding

CONSIDERABLE discussion is being devoted to the roadbuilding problem at the present time. Although it probably is next in importance to housing, it is not receiving the consideration due it, and some phases of the problems are almost entirely neglected. One of these neglected phases is the matter of costs, despite the fact that some states seem to think they have settled that matter by restricting roadbuilding so long as costs remain high.

In my opinion, anything tending to defer the building of paved highways is to be deplored, and I feel sure that considerable progress could be made if both the highway departments and contractors were to make a thorough study of the problem of costs and inaugurate methods that would work toward a satisfactory solution.

The more important reforms that I think should be made are:

Abolish the practice of preparing an engineer's estimate of the cost of the work for distribution among the prospective bidders.

2. Increase the amount of the certified check or bid bond to be filed with the bid.

3. Make contracts more attractive by broadening business practices and eliminating petty restrictions.

4. Provide for the letting of highways in long stretches on a prime contract, and permit the general contractor to sublet any sections, thereby making it possible to perfect an efficient centralized organization.

AN OFFICE ON THE JOB IN A SHADY SPOT LIKE THIS HELPS IN THE JOB OF RECORDING COSTS

In order to carry out successfully a construction program, whether it be that of roadbuilding, housing or any form of betterment work, the highest degree of co-operation between the interested parties must exist, and this can only be obtained by fair dealing and frankness.

There is no doubt that an increase over the letting of July 9, 23, and 30, and August 13, 1919, was noted when the Illinois bids were opened in Springfield on February 25 and March 3 last, but a careful study of comparative figures of the summer and fall lettings, compiled by C. W. Olson, and the bids and unit prices received at the letting of February 25 and March 3, 1920, indicates, in my opinion, that the estimates submitted by the contractors are not exorbitant. On the other hand, compared with the actual cost of constructing roads during last year, and the conditions under which they were constructed, the bids are conservative. However, the wide variation in the contractors' own figures as well as those of the state engineers brings to light the truthfulness of a remark made by R. R. Richards, who said:

"If there is an unpardonable sin in business it is probably the sin of acting on 'approximate' figures. A total that is 'approximately' right is also 'approximately' wrong."

This probably explains why there is almost always a difference of 5% to 35% between the contractor's figures and those of the state engineers. The fact that the state furnished an estimated cost of the road to be constructed also acts as a hindrance, for, unless a change has been made recently, these estimated costs are not based on actual costs obtained from a similar stretch of road. Then when a road contractor who is not certain as to his costs prepares his bid, using the state's estimate as a basis, trouble is almost sure to follow.

The privilege of presenting bids without cost to the contractor also is a detriment to successful roadbuilding and in fact all construction work.

I have in mind one locality where the bids on two jobs were opened and the figures on one ran about as follows: $90,000, $120,000, $122,000, $130,000, etc., while on the other they ran practically the same. Needless to say, the contractor who submitted the $90,000 bid carried his bookkeeping in his vest pocket, but in any event he forfeited his certified check on one job (as certified check was asked only on one job) and refused to sign the contract on the other, thereby causing a lot of inconvenience and unnecessary cost to the other contractors, architects and owners.

On a job in the East the successful contractor expended his plant estimate before the job was half completed and for the remaining five months lost at the rate of $100 per day. This was only one of his many losses due to his lack of knowledge of costs. For example, he used teams and autos when on his particular job tractors and industrial track would have been less expensive, thus reducing the costs and promoting efficiency.

On another project the general contractor forgot entirely to make provision for obtaining and transporting his labor, as well as the operation of commissaries, and his estimate for the installation of temporary pipe lines was considerably less than the actual cost of constructing them.

In both of these cases the losses were due to the fact that a preliminary survey of the project was not made, and there was no systematic manner of preparing estimates based on actual cost figures.

I believe that if a census of all contractors were taken today we would find that no more than 25% are capable of determining whether there is a profit or loss on their contracts in the course of construction, and the same percentage at the conclusion of their jobs are equally as unable to tell on what part of the work the profit was made or where the loss occurred.

As an example of what can be done I quote some of the results attained by one of the general contractors in Illinois from a simple progress and cost report.

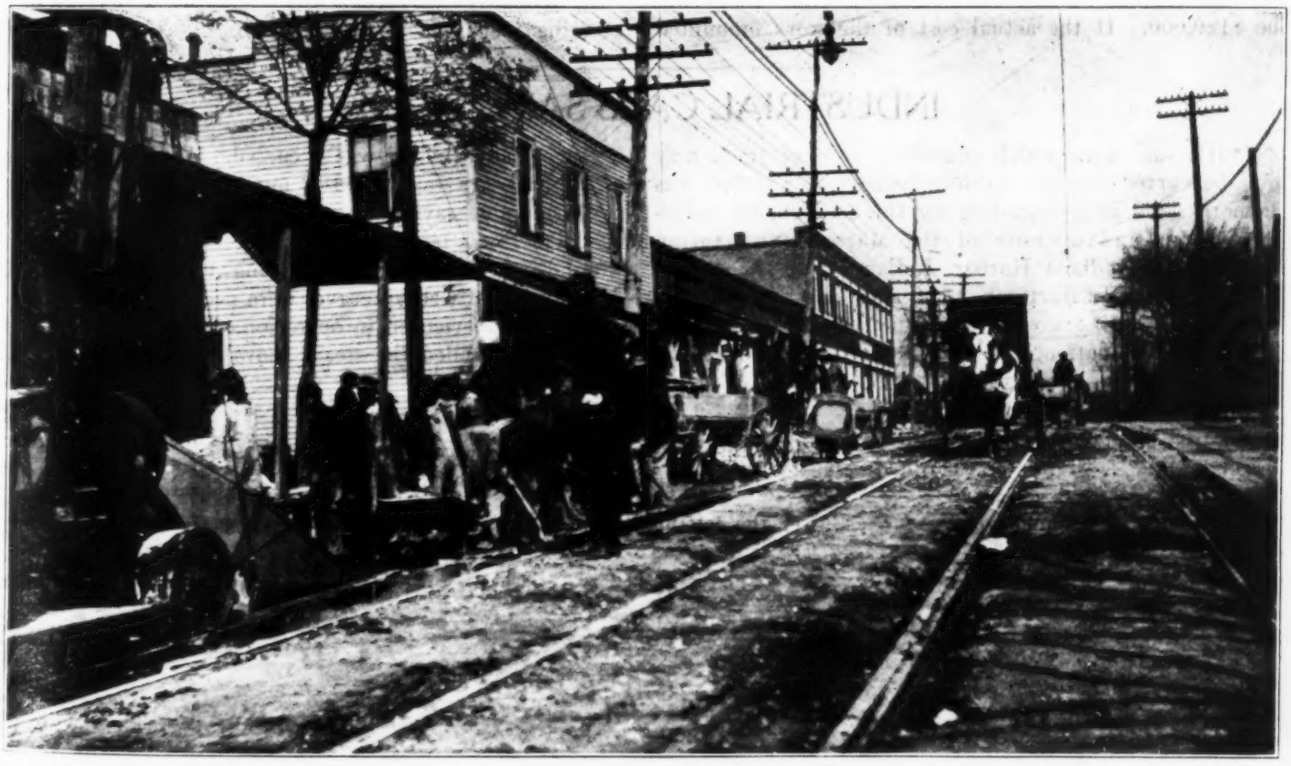
This report was furnished to the main office each week, and upon applying the estimated costs against the actual expenditures, it was noted that work was being performed which was not covered by the original contract or a change order, and that the cost of operating the field office and commissaries was greatly exceeding the estimates, also that the cost of unloading was too high. With this information, an analysis of the costs was made and it was found that little system was used in ordering material, and consequently the telephone and telegraph charges were excessive. In order to reduce the operating loss on the commissaries it was decided to make a change in management and also increase the price per meal from 35 to 40 cents. A change was made in the unloading bins and the switch tracks so that it was possible for the steam shovel to unload one-half again as many cars as formerly. One of the changes which tended to produce the most efficiency was that of constructing the bins in a semi-circle.

In order to eliminate the all too common bad practice of failing to figure costs accurately which has as its ultimate result bankruptcy and unsatisfactory work, a uniform general and cost accounting system, simple in design and easy to operate should be adopted by all contractors. It should show cost of work in progress, and the actual profit or loss on completed contracts.

There is just as much harm in having too much system as in having none at all, so in adopting a standard system all points must be taken into consideration. Particular attention should be paid to purchases, as often 30% to 60% of the value of the contract is spent for material and equipment.

The chief engineer of the department of public works in one of our large Eastern cities, in an address delivered before a contractors' association several months ago, laid special emphasis upon the advantages of organization, but he also took occasion to express his sentiments regarding the cut-throat methods of bidding and was inclined to favor bids based on an intelligent estimate of costs so as to guarantee successful completion of the work without loss to the contractor.

I believe that there is plenty of room for improvement in the letting of contracts as well as the form of contract covering road construction, for under present conditions a contractor is apt to get two or more small sections of road separated by other small sections let to some other contractor, and as a consequence he is forced to have a separate field organization, unloading bins, and practically the same amount of equipment for each section. The work should be laid out so that in addition to



A LITTLE MORE ATTENTION TO COSTS ON THIS JOB MIGHT HAVE DISPENSED WITH SOME OF THE SEMI-WORKERS WHO ARE CROWDED SO CLOSE TOGETHER THEY CAN HARDLY MOVE.

making a good highway the contractor can get the most economical use of his equipment and take any other steps necessary to keep costs at a minimum.

Considerable headway can be made towards making road contracts more attractive if the state will abolish the retained percentage clause, eliminate some of the red tape so that the contractor will receive a warrant for the approved estimate the first week of the following month, and eliminate various petty restrictions which place unnecessary burdens upon the contractor.

After making a thorough study of the different forms of contracts and construction conditions surrounding roads, I am firmly convinced that both the state highway departments and the contractors will find a happy medium in the lump-sum-fixed-fee contract with the bonus and penalty clause, providing that the contractor receive 25% of the saving up to 25% of the original fee if the actual cost underruns the estimated cost, while on the other hand the contractor should be penalized up to 25% of the original fee if the actual cost exceeds the original estimate. Under this form of contract the contractor should prepare an estimate by parts of the work to be performed, and submit it with a lump-sum figure, as his estimated cost of the work.

Based on the estimated cost arrived at in this manner, a fee of 10 per cent, or $100,000 on a $1,000,000 contract, is named as the general contractor's fee for supervision of the work. At the completion of the contract the actual cost is applied against the estimated cost, plus or minus the amount of the change orders, and the overrun or underrun determined.

On a million dollar contract then, if the additions are $250,000, and the deductions $50,000, the corrected estimated cost at the conclusion of the contract would be $1,200,000. On this basis the contractors' fee would be $120,000. If the actual cost of the work amounted to $1,000,000, the general contractor would receive $120,000, plus 25% of $120,000, ($30,000) or $150,000. On the other hand, should the work cost $1,400,000, the general contractor would be penalized $30,000, cutting his fee to $90,000.

The plant rental should be a fixed sum to cover all ordinary equipment usually furnished by general contractors as well as repairs which materially add to the value or prolong the life of the asset. All other repairs and expense should be borne by the state. In order to avoid any discussion or misunderstanding as to the equipment to be furnished by the general contractor, a list of the equipment included in the plant rental should be incorporated in the contract. The amount of plant rental should depend entirely upon the work involved, and the equipment to be furnished.

Provision should be made to reimburse the contractor for all disbursements made by him to cover the labor and material, soon after his vouchers have been presented, and a standard system to handle the general and cost accounting should be installed on each road job, from which could be compiled a weekly progress and cost report for the contractor and state highway department, which would enable both sides to check the actual costs against the estimated costs as the work progresses and compile accurate costs for future reference.

Until the average contractor knows his costs inside and out, is prepared to defend the figures in his bid with facts and not with theories or guesses, the present uncomfortable situation will continue. State highway officials will keep on shying at high prices despite the well known increases in the costs of material and labor, simply because the contractor can't or won't back up his bid with cost facts.

The contractors of this country are too intelligent a class of men to perpetuate the guesswork system of discovering costs. It is bound to go.

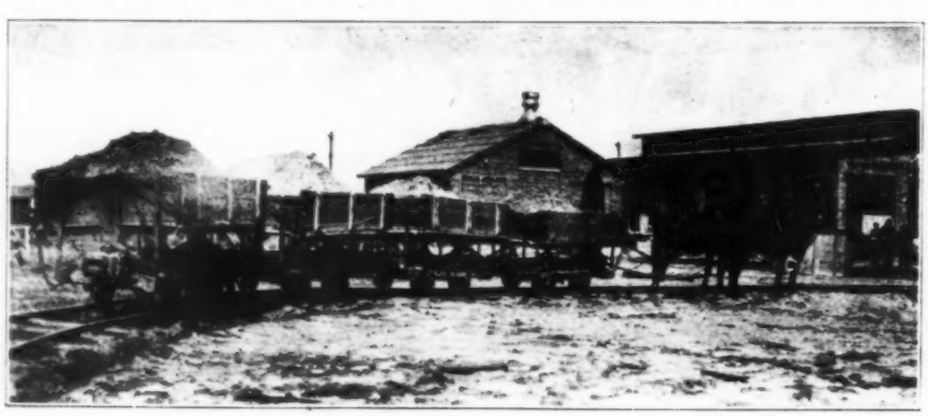
INDUSTRIAL CARS SAVE TEAMS

THE ease with which industrial railway track may be curved around building corners and moved was demonstrated in the grading for the $33,000,000 industrial plant and townsite of the Mark Manufacturing Company at Indiana Harbor, Indiana.

The A. F. Hartigan Company of Chicago, contractors, in filling around the building and excavating the plant foundation, used about a half mile of 24-in. gauge track laid on 3 ft. ties and an outfit of 1½ cu. yd. dump cars.

The material handled was a yielding sand which made the use of dump wagons or wheeled scrapers difficult. The average load to a car was 2 cu. yd. A train consisting of 4 dump cars was hauled by one team, thereby effecting a considerable saving in team time.

Track was laid and trains of dump cars operated in, around and between the building under construction. Many unusually sharp curves were necessary, but no difficulty was experienced in operation. Two trains of dump cars each supplied the steam shovel that was loading.



NEGOTIATING A SHARP CURVE

Mr. Hartigan believes that a similar installation can be used with economy on a 5,000 cu. yd. job and a haul as short as 500 ft., if the equipment is at hand. The flexibility of the outfit is its great advantage.

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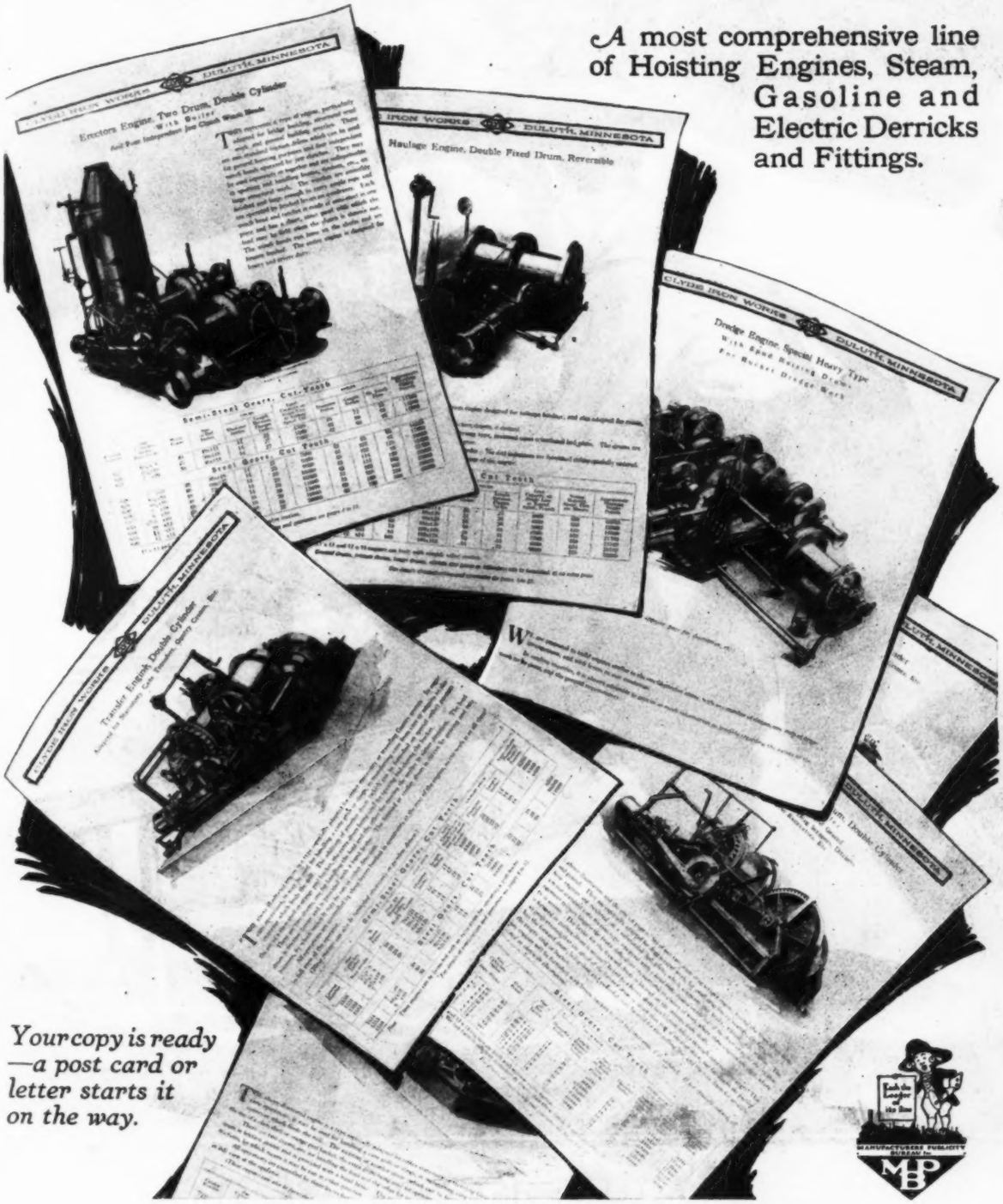

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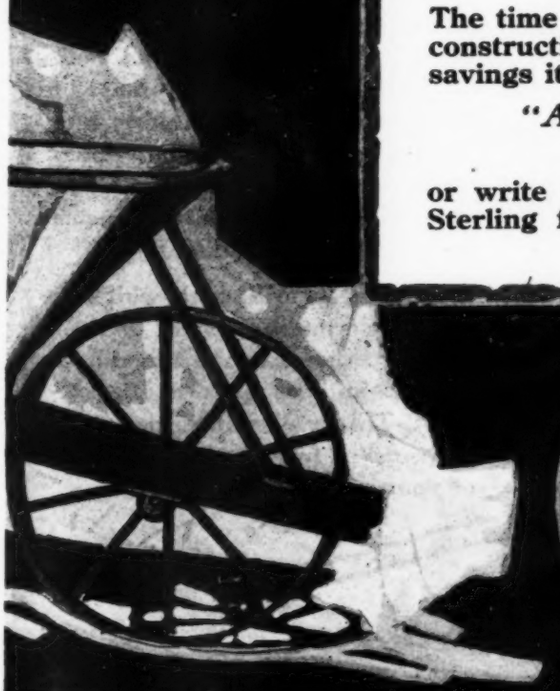

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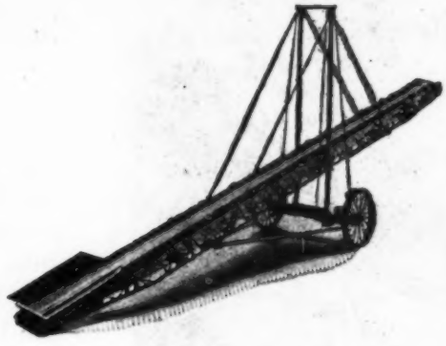

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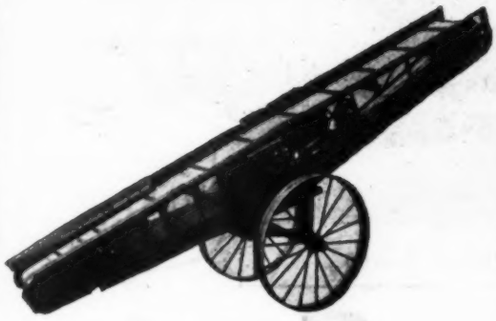

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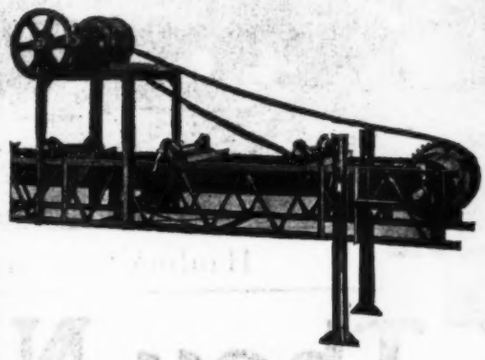

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